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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/684,503

10/15/2003

Hitoshi Sakamoto

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11/14/2006

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EXAMINER

BUEKER, RICHARD R

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 11/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/684,503

Applicant(s)

SAKAMOTO ET AL.

Examiner

Richard Bueker

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1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 20 and 39-45 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 20 and 39-45 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

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Claims 20 and 39-45 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 20 as amended recites "reducing gas heating means . . . for injecting the atomic reducing gas into the chamber" but this language does not appear to have been included in the specification as originally filed. Applicants have indicated that this limitation is supported at page 70, lines 17-19, but it is noted that the cited passage states that the injecting is done by the nozzle 215 rather than the reducing gas heating means 253. In claim 42, the phrase "the reducing gas heating means comprises a flow controller" does not appear to have been included in the specification as originally filed. Applicants have indicated that this limitation is supported at page 70, lines 13-15, but it is noted that the cited passage states that the flow controllers 214 are separate from the reducing gas heating means 253. In claim 45, the phrase "the predetermined temperature of the inner wall is higher than a temperature of the substrate" does not appear to have been included in the specification as originally filed. Applicants have indicated that this limitation is supported at page 32, lines 18-24, but it is noted that the cited passage does not discuss the temperature of the substrate, or the temperature of the inner wall relative to the temperature of the substrate.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 20, 39-42 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Claverie (5,091,209) taken in view of Torres (EP 573348) (see the attached English translation) and Madar (Microelectronic Engineering 19 (1992) pages 571-574) and optionally in further view of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172).

Claverie (Fig. 1) discloses an apparatus for formation of a copper film comprising a precursor feeding means for bringing a chlorine containing raw material gas into contact with a hot metallic copper element to produce a precursor within a chamber housing a substrate to be coated, the precursor comprising the copper of the hot copper element and the chlorine contained in the raw material gas. Claverie teaches (see col. 2, line 50 to col. 3, line 5) that the copper containing precursor gas that is produced comprises CuCl. In Claverie's apparatus, the chlorine containing raw material gas is itself a precursor gas, and therefore the claim limitation of "precursor feeding means" reads on the chlorine containing gas feeding means of Claverie alone. The claim 20 limitation of "for bringing a chlorine-containing raw material gas into contact with a hot metallic filament" is a recitation of intended use that does not require the presence of a filament in the claimed apparatus. The chlorine containing gas precursor feeding means of Claverie is inherently capable of feeding to a filament.

Claverie's Fig. 1 apparatus also includes a reducing gas heating means (filament 14 of Fig. 1) for heating a hydrogen containing reducing gas to a high temperature and thereby producing an atomic reducing gas, and injecting the atomic reducing gas into the chamber between the substrate and the precursor feeding means. The dictionary definition of "inject" (see attached copy) includes "to introduce as an element or factor in or into some situation". According to this definition, Claverie's hot filament 14 injects atomic hydrogen into the chamber because it introduces atomic hydrogen as an element into the chamber.

Claverie does not discuss the use of chamber heating means for heating an inner wall of the chamber to a predetermined temperature as recited in claim 20. Torres (EP 573348) discloses a copper film forming apparatus that is analogous to that of Claverie, and Torres (see page 13, lines 1-4 of the English translation) teaches that the walls of the coating chamber should be heated to prevent CuCl from depositing on the walls. Torres makes clear that deposition of CuCl on the chamber walls is undesirable. It would have been obvious to one skilled in the art to provide a chamber wall heater in Claverie's apparatus to prevent undesirable CuCl deposition on the chamber walls as taught by Torres. Madar is cited for his teaching (see page 572, second and third paragraphs, and Figs. 1 and 2) that CuCl was known in the art to be a non-volatile compound that is solid below 650° K. This teaching of Madar makes it further obvious to one skilled in the art to heat the chamber walls of Claverie to prevent undesirable deposition of CuCl.

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As noted, above, claim 20 as written does not require the presence of a metal filament. If for the sake of argument however, claim 20 was interpreted to require the presence of a hot metallic filament as a source for producing the metal containing precursor, such would still be obvious in view of the teachings of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172). Inoue (see fig. 2, element 11), Arena-Foster (fig. 4, element 64) and Bhandari (see paragraph bridging cols. 2 and 3 and also col. 3, lines 14-17) all disclose vapor sources for CVD apparatus of a type analogous to that of Claverie, and they all teach that a hot metallic source element for forming the precursor gas can be in the form of a filament. It would have been obvious to one skilled in the art to modify the apparatus of Claverie by substituting a filament-type hot metallic element for the hot metal tube of Claverie, because Inoue, Arena-Foster and Bhandari make clear that a metal filament is an alternate equivalent form of a metal source that works well for Claverie's intended purpose, which is to successfully provide reactive precursor gas to a CVD reactor.

Claims 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Claverie (5,091,209) taken in view of Torres (EP 573348) (see the attached English translation) and Madar (Microelectronic Engineering 19 (1992) pages 571-574) and optionally in further view of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172) for the reasons stated in the rejection of claims 20, 39-42 and 45 above, and taken in further view of Sun (6,161,499). Sun teaches (see col. 9, lines 10-14 and claim 5) that AC and DC power supplies are functionally equivalent for the purpose of resistively heating a

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filament. Therefore, it would have been prima facie obvious to one skilled in the art to choose a DC power source to heat the filament 14 of Claverie or the filaments of Arena-Foster, Bhandari and Inoue, because one skilled in the art would have expected a DC power source to successfully produce the desired heating of these hot filaments.

Claims 20, 39-42 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Claverie (5,091,209) taken in view of Torres (EP 573348) (see the attached English translation) and Madar (Microelectronic Engineering 19 (1992) pages 571-574) and optionally in further view of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172), and in further view of Lee (Thin Solid Films), Ishihara (5,154,135) and Oshita (JP 64-042394).

In the first prior art rejection above, it was noted that the dictionary definition of "inject" includes "to introduce as an element or factor in or into some situation". According to this definition, Claverie's hot filament 14 injects atomic hydrogen into the chamber because it introduces atomic hydrogen as an element into the chamber. It is noted, however, that the definition of "inject" also includes "to force a fluid into". If for the sake of argument, claim 20 was interpreted to require an injecting pipe for forcing atomic reducing gas into the chamber from the outside, such would still be obvious when considered in further view of Lee, Ishihara and Oshita. Lee (see Fig. 1 and page 40, first paragraph) discloses an apparatus for depositing copper that is analogous to that of Claverie. As in Claverie, Lee deposits a copper film by using atomic hydrogen to reduce CuCl. Lee teaches that the atomic hydrogen can successfully be injected into the

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chamber from the outside. Also, Ishihara (see col. 4, line 54 to col. 5, line 27, and particularly col. 4, lines 63-66) and Oshita (see abstract and Fig. 2), teach that it was well known in the art to produce atomic hydrogen thermally in a separate chamber for injecting it into a reaction chamber. Oshita in particular teaches that a tungsten filament can be use as the heating means for producing atomic hydrogen. It would have been obvious to one skilled in the art to modify the apparatus of Claverie by providing it with an external atomic hydrogen producing means as a substitute for Claverie's internal atomic hydrogen producing means, because Lee teaches that injecting atomic reducing gas into the chamber from the outside is an equivalent successful way of producing the copper film desired by Claverie.

Claims 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Claverie (5,091,209) taken in view of Torres (EP 573348) (see the attached English translation) and Madar (Microelectronic Engineering 19 (1992) pages 571-574) and optionally in further view of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172), and in further view of Lee (Thin Solid Films), Ishihara (5,154,135) and Oshita (JP 64-042394) for the reasons stated in the rejection of claims 20, 39-42 and 45 above, and taken in further view of Sun (6,161,499). Sun teaches (see col. 9, lines 10-14 and claim 5) that AC and DC power supplies are functionally equivalent for the purpose of resistively heating a filament. Therefore, it would have been prima facie obvious to one skilled in the art to choose a DC power source to heat the filament 11 of Oshita or the filaments of Arena-Foster, Bhandari and Inoue, because one skilled

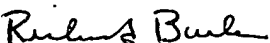
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in the art would have expected a DC power source to successfully produce the desired heating of these hot filaments.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard Bueker whose telephone number is (571) 272-1431. The examiner can normally be reached on 9 AM - 5:30 PM, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Richard Bueker
Primary Examiner
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